#25 Appeal Brief 11-2-98 M.R

Attorney's Docket No. 17564-040
(Formerly A0626/7029)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT:	Soutar et al.	EXAMINER:	B. Talbot
		ART UNIT:	1762
SERIAL NO.:	08/932,392		
FILED:	September 1, 1997		
FOR:	PROCESS FOR SILVER PLATING IN PRINTED CIRCUIT BOARD MANUFACTURE		

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APPEAL BRIEF

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

This Appeal Brief is filed in connection with the Notice of Appeal filed on August 19, 1998. This Appeal relates to the Office Action dated June 1, 1998.

REAL PARTY-IN-INTEREST:

The real party-in-interest in the above-entitled application are the inventors, Andrew McIntosh Soutar and Peter Thomas McGrath.

RELATED APPEALS AND INTERFERENCES

No related appeals or interferences relating to the above-identified application are currently pending.

STATUS OF CLAIMS

Claims 1-18, 20-26 and 34-44 are currently pending in the above-identified application. No other claims are pending in the application. The applicants note that the Advisory Action dated July 23, 1998 states that the pending claims are 1, 3-7, 10-16, 21-26 and 34-43. The applicants believe that this listing of claims is in error.

As noted in the Notice of Appeal, the applicants' undersigned attorney spoke with Examiner Brian K. Talbot on August 19, 1998 to discuss the discrepancy between the claims listed on the Advisory Action and the claims listed in the final Action. Examiner Talbot agreed that the Advisory Action was in error, and that it should have listed Claims 1-18, 20-26 and 34-44 as being rejected. The Notice of Appeal stated that the appeal is intended to include each of these pending claims. Thus, the applicants consider Claims 1-18, 20-26 and 34-44 as being the subject of this appeal.

The applicants' position is confirmed by the "Letter Regarding Claims Being Appealed" filed in connection with the Notice of Appeal on August 19, 1998.

STATUS OF AMENDMENT

The Advisory Action notes that the amendments to Claims 1, 18, and 44 made in the applicants' Reply Under 37 CFR § 1.116, dated July 13, 1998 will be entered upon the filing of a Notice of Appeal and an Appeal Brief. Thus, the applicants believe that all amendments filed during the pendency of this application have been entered.

SUMMARY OF THE APPLICANTS' INVENTION

The present invention relates to the application of a protective layer upon a surface of a printed circuit board. Specifically, the printed circuit board includes runs or traces formed of copper, upon which are formed a protective silver layer. The silver layer is formed on the copper traces using a displacement immersion silver plating process (Page 11, lines 13-19). Such displacement plating processes differ from electrolysis processes in that, in the former, the silver coating forms on the surface of the copper by means of a simple displacement reaction which results from the relative electrode potentials that exist between the copper and the silver. Thus, copper present on the surface of the printed circuit board is protected by thin overlayer of silver which prevents copper oxidation (Page 19, lines 21-24).

The present application overcomes several problems known in the prior art for providing silver protective coatings. In particular, the present invention allows the elimination of ammonia, cyanide ions, formaldehyde, thiosulfate and reducing sugars from the plating process (Page 11, lines 20-23). The invention also offers the ability to provide a silver coating with good adhesion and solderability.

In a broad sense, the present application relates to a process for forming a silver coating upon the surface of a metal having an electropositivity that is less than the electropositivity of the silver (Page 19, lines 10-14). For simplicity in this description, the metal having electropositivity less than that of silver will be described as copper,

however, it is to be understood that the invention is not intended to be limited as such, and rather, copper is substituted simply for semantic purposes. In the process, the surface of the copper is coated with an aqueous composition which includes silver ions and a complexing agent that is a multidentate ligand. The aqueous composition has a pH in the range of about 2 to about 12 and is specified as being free of ingredients selected from the group consisting of ammonium ions, thiosulphate ions, and combinations thereof (Claims 1,18, 44). When a printed circuit board having copper traces thereon is subjected to the claimed process, the result is a printed circuit board having copper traces upon which are deposited a thin layer of silver. Of course, as noted above, the invention as claimed is not intended to be limited strictly to printed circuit boards having copper traces, but rather to those circuit boards having traces formed of any metal having an electropositivity that is less than the electropositivity of silver.

ISSUES

1. Whether Claims 1, 3-7, 10-16, 21-26 and 34-43 are unpatentable under 35 U.S.C. § 103 over U.S. Patent No. 3,993,845 to Greenberg et al. ('345 Patent) in view of U.S. Patent 5,322,553 Mandich to et al. ('553 patent).

2. Whether Claims 2, 17, 18 and 44 are unpatentable under 35 U.S.C. § 103 over the '845 patent in view of the '553 patent and further in view of the applicants' admitted state of the art (specification, page 1, line 8 - page 9, line 26).

3. Whether Claims 8, 9 and 20 are unpatentable under 35 U.S.C. § 103 over the '845 patent in view of the '553 patent and further in view of U.S. Patent No. 4,067,784 to Leahy et al. (the '784 patent).

GROUPING OF CLAIMS

Each of the claims pending in the current application stand or fall together. Claims 1, 18 and 44 are independent claims, and of these Claim 1 is the broadest.

ARGUMENT

Each of the claims pending in the present appeal has been rejected under 35 U.S.C. § 103 as being unpatentable, at least in part, over the combination of the Greenberg '845 patent and the Mandich '553 patent. As will be pointed out herein, it is the applicants' contention that the rejection of the pending claims wholly or partially on the basis of the combination of the '845 patent and the '553 patent is in error.

The Greenberg '845 patent is said to teach novel copper-silver metallic films prepared on transparent articles by chemical replacement of silver for copper. More particularly, reference describes a transparent article that has been covered by copper using conventional deposition methods. A silver substitution is then carried out by contacting the copper-coated article with a solution including a silver salt, ammonia and a complexing agent which promotes replacement but which does not accelerate the oxidation of residual metallic copper in the film. The rejections have noted that the Greenberg '845 patent teaches a silver plating solution which is free of thiosulphate ions (June 1, 1998 Action, page 3, lines 4-6).

The rejections have also noted that the Mandich '553 patent teaches electroless plating compositions which do not contain ammonia, formaldehyde, cyanide, etc. (June 1, 1998 Action, page 3, lines 9-10). The rejections have noted that the Mandich '553 patent teaches that formaldehyde does not make the plating bath stable or commercially usable on a large scale and that the use of ammonia either as a stabilizer, a complexing agent, or both is known to be very shock sensitive. Thus, the rejections have concluded that it would have been obvious for one skilled in the art at the time of invention was made to

modify the (thiosulfate-free) silver plating solution of the Greenberg '845 patent by making the plating solution free of ammonia as suggested by Mandich '553 patent, because one skilled in the art would want to avoid the problems associated with the use of ammonia as evidenced above.

The applicants have previously argued that the Greenberg '845 patent failed to teach a displacement process without the use of additional additives such as ammonia or thiosulphate ions, and the examiner has agreed with those comments. However, the rejections of the subject claims over the combination of the Greenberg '845 patent and the Mandich '553 patent have been maintained on the basis that one cannot show non-obviousness by attacking references individually when the rejection is based upon a combination of the references.

In overcoming a rejection based upon a combination of references, it is proper to show, among other things, that (a) there would have been no suggestion in the art to combine the references, (b) the references cannot properly be combined, and/or (c) even if the references are combined, the combination would not have suggested the invention claimed by the applicant.

In the present case, the applicants take the position that each of the cited reasons for non-obviousness over the cited art applies. Specifically, the Greenberg '845 patent relates to a method for preparing copper-silver metallic films on a transparent surface by providing that surface with a copper layer and then reacting the copper-layered surface with a solution comprising a silver salt, *ammonia* and a complexing agent. The Greenberg '845 patent explicitly states "thiosulfate complexing agents are not employed since thiosulphate has been found to accelerate the subsequent oxidation of residual copper in the film..." (Column 3, lines 14-17). In contrast, the Mandich '553 patent describes an electroless silver plating solution having a silver complex, *a thiosulphate salt* and a sulfate salt.

At the outset, the applicants note that since Greenberg '845 patent states that thiosulphate complexing agents are not employed, whereas the Mandich '553 patent explicitly requires the use of thiosulphates, the references explicitly teach away from one another, and, as such, away from combination. In particular, if a reference explicitly states that a particular chemical species should not be used, that reference teaches away from a second reference which requires the use of that same species. Thus, rather than containing a suggestion that the references should be combined, these references explicitly teach away from any such combination.

Likewise, it is unclear how the references could properly be combined since the Greenburg '845 patent teaches away from the use of a thiosulphate, whereas the Mandich '553 patent explicitly requires the use of a thiosulphate. Conversely, whereas the Greenberg '845 patent explicitly requires the use of ammonia or an ammoniacal silver salt, the Mandich '553 patent explicitly states, "The bath does not contain ammonia or cyanide ions as a plating constituent, and has a plating rate and a plating solution stability far greater than previously known electroless silver baths" (Column 1, lines 50-54). Since each of the Greenberg '845 and Mandich '553 patents includes a chemical species that is explicitly excluded from the other reference, the references cannot be properly combined. If the references were to be theoretically combined, the result would be an impossibility, i.e., a material which simultaneously does not employ a thiosulphate and does employ a thiosulphate, and which simultaneously does not employ an ammonia species and does employ an ammonia species. Since such a compound clearly cannot exist, any combination of the references will be improper.

Furthermore, the Greenberg '845 patent clearly states, "thiosulphate complexing agents are not employed since thiosulphate has been found to accelerate the subsequent oxidation of residual copper in the film..." (Column 3, lines 14-17). Likewise, the Mandich '553 patent clearly states, "An object of the present invention is to provide an

electroless silver plating solution which uses a novel reducing agent system. The system comprises the redox system thiosulfate-sulphite-sulfate" (Column 1, lines 44-47). If the Greenberg '845 patent explicitly seeks to employ a system which does not employ thiosulphates, why would one seek to combine it with a system that is based primarily upon the use of thiosulphates? Not only is there no suggestion in the art that the references should be combined, but rather, there is a clear explicit statement in the Greenberg '845 patent that the references cannot be combined.

Finally, even if the references were combined, they would not have suggested the applicants' claimed processes in which a silver coating is formed on the surface of a metal using an aqueous composition that is free of ammonium ions, thiosulphate ions, and combinations thereof. Assuming for the sake of argument that one were to combine the Greenberg '845 patent and the Mandich '553 patent, despite the teaching to the contrary, the resulting combination would also fail to suggest the claimed subject matter. The Greenberg '845 patent relates to a system that employs an aqueous solution of an ammoniacal silver salt and a complexing agent (Column 3, lines 9-11). Thiosulphate complexing agents are not employed (Column 3, lines 14-17). Mandich, on the other hand, employs a thiosulphate-sulphite-sulfate redox system (Column 1, lines 46-47). The bath does not contain ammonia or cyanide ions as a plating constituent (Column 1, lines 50-52). Thus, a combination of the references would yield a plating bath that contains ammonia and not thiosulphate (Greenberg '845) while at the same time contains thiosulphate and not ammonia (Mandich '553). In reality, of course, such combination would not be possible as the references mutually exclude one another. Rather, a plating solution containing both ammonia and thiosulfate would result.

To use a simple analogy, one can consider combining two bags filled with fruit. The first bag contains apples and no oranges. The second bag contains oranges and no

apples. A combination of these two bags would not result in a mixed bag of fruit containing neither apples nor oranges. Rather, the results would be a combination of both apples and oranges.

Since the Greenberg '845 patent teaches the use of ammonia and the Mandich '553 patent teaches the use of a thiosulphate, the combination of the two references would be a solution that employs both ammonia and thiosulphate. It would not be a solution that contains neither ammonia nor thiosulphate. The applicants note that each of the pending claims requires the absence of both ammonium ions and thiosulphate ions. Thus, the combination of the Greenberg '845 patent and the Mandich '553 patent would not have suggested the subject matter of the applicant's claims.

Thus, the cited combination, taken alone or with any of the other references (which were cited for unrelated reasons), would have failed to suggest the applicant's claimed combination. Since the combination of the Greenberg '845 patent with the Mandich '553 patent is the primary basis for rejection of all pending claims, in overcoming the rejection based upon that combination, all pending rejections should be withdrawn. As such, the rejection of all pending claims should be withdrawn, and the application should be allowed to pass to issue.

APPENDIX

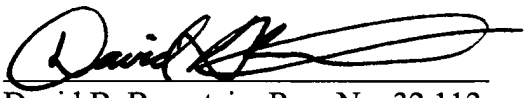
An Appendix containing a listing of each of currently pending claims 1-18, 20-26 and 34-44, as currently amended, is attached.

CONCLUSION

In view of the foregoing, each of the applicant's pending claims should be allowed.

Respectfully submitted,

MINTZ, LEVIN, COHN, FERRIS
GLOVSKY AND POPEO, PC



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APPENDIX

Pending Claims
Attorney Docket No. 17564-040
Serial No. 08/932,392

1. A process for forming a silver coating on a surface of a first metal having a first electropositivity less than an electropositivity of silver, the process comprising a step of:

(a) contacting the surface of the first metal with an aqueous composition comprising silver ions and a complexing agent that is a multidentate ligand, the aqueous composition having a pH of from 2 to 12, to form a coating of silver on the surface of the first metal, wherein the aqueous composition is free of ammonium ions, thiosulphate ions and combinations thereof

2. A process according to claim 1, wherein step (a) includes contacting the aqueous composition with a surface of the first metal having conductive metal pads, conductive metal through-holes or a combination thereof of a bare board, and in which the substrate includes non-metallic areas which remain uncoated in the process.

3. A process according to claim 1 or claim 2, wherein the surface of the first metal is a copper surface and step (a) includes contacting the copper surface with the aqueous composition.

4. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the complexing agent has a first molarity and the silver ions have a second molarity, the first molarity being greater than the second molarity.

5. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the silver ions are present at a concentration of from 0.06 g/l to 32 g/l.

6. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the complexing agent is present in an amount of from 0.1 g/l to 250 g/l.

7. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the complexing agent is selected from the group consisting of ethylenediamine tetra-acetic acid, diethylenetriamine penta-acetic acid, N,N,N',N'-tetrakis(2-hydroxy propyl) ethylene diamine and mixtures thereof.

8. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition which further includes an ingredient selected from the group consisting of a surfactant, wetting agent, stabilizer, grain refiner, tarnish inhibitor and mixtures thereof.

9. A process according to claim 8, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which a surfactant has a concentration of from 1 g/l to 15 g/l.

10. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition free of any reducing agent capable of reducing the silver ions to silver metal.

11. A process according to claim 1, wherein step (a) includes a step of spraying the aqueous composition or dip-coating the aqueous composition in an immersion bath.

12. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition for from 10 seconds to 10 minutes at a temperature of from 10^0C to 60^0C.

13. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition so that the silver coating on the first metal is less than 0.5 μm thick.

14. A process according to claim 1, further comprising, prior to step (a), a step of contacting the surface of the first metal with an acidic cleaning solution to clean the surface of the first metal.

15. A process according to claim 1, further comprising, prior to step (a), a step of micro-etching the surface of the first metal.

16. A process according to claim 1, further comprising steps of: rinsing the coating of silver; and drying the coating of silver.

17. A process according to claim 1, further comprising a step of soldering a conductor component to the coating of silver.

18. A process for producing a bare printed circuit board comprising steps of:

i) providing a substrate having exposed metal conductor traces and pads through-holes or a combination thereof, the metal having an electropositivity less than an electropositivity of silver,

ii) applying a mask to cover at least the traces and to leave at least some of the pads, the through-holes or the combination thereof exposed, the mask being an insulator, and

iii) contacting the metal surface with an aqueous composition comprising silver ions and a complexing agent that is a multidentate ligand, the aqueous composition having a pH of from 2 to 12, to form a coating of silver on the metal surface, wherein the aqueous composition is free of ammonium ions, thiosulphate ions and combinations thereof.

20. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition including a buffering agent.

21. A process according to claim 4, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the first molarity is twice as large as the second molarity.

22. A process according to claim 5, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the silver ions are present at a concentration of from 0.1 g/l to 25 g/l.

23. A process according to claim 5, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the silver ions are present at a concentration of from 0.5 g/l to 15 g/l.

24. A process according to claim 6, wherein step (a) includes contacting the surface of the first metal with an aqueous composition in which the complexing agent is present in an amount of from 10 g/l to 100 g/l.

25. A process according to claim 10, wherein step (a) includes contacting the surface of the first metal with an aqueous composition free of halide ions.

26. A process according to claim 12, wherein step (a) includes contacting the surface of the first metal with an aqueous composition at a temperature of from 150 C to 50^{0}C.

34. A process according to claim 1, wherein step (a) includes contacting the surface of the first metal with an aqueous composition that is free of ingredients selected from the group consisting of cyanide ions, formaldehyde, reducing sugars and combinations thereof.

35. A process according to claim 1, wherein step (a) includes contacting the aqueous solution with a surface of the first metal having conductive metal pads, conductive metal through-holes or a combination thereof of a bare board, and in which the substrate includes solder-mask coated areas.

36. A process according to claim 18, wherein step (a) includes contacting the surface of the first metal with an aqueous composition that is free of ingredients selected from the group consisting of cyanide ions, formaldehyde, reducing sugars and combinations thereof.

37. A process according to claim 18, wherein the exposed metal conductor is an exposed copper conductor.

38. A process according to claim 18, wherein the silver ions are present in the aqueous composition at a concentration of from 0.06 g/l to 32 g/l.

39. A process according to claim 18, wherein the complexing agent of the aqueous solution has a first molarity and the silver ions of the aqueous solution have a second molarity, the first molarity being greater than the second molarity.

40. A process according to claim 18, wherein the complexing agent of the aqueous composition is present an amount from 0.1 g/l to 250 g/l.

41. A process according to claim 18, wherein the complexing agent of the aqueous composition is selected from the group consisting of ethylenediamine tetra-acetic acid, diethylenetriamine penta-acetic acid, N,N,N',N'-tetrakis (2-hydroxy propyl) ethylene diamine and mixtures thereof.

42. A process according to claim 18, wherein the aqueous composition further includes a compound selected from the group consisting of a surfactant, a wetting agent, a stabilizer, a grain refiner, a tarnish inhibitor and mixtures thereof.

43. A process according to claim 42, wherein the complexing agent is a surfactant that has a concentration of from 1 g/l to 15 g/l in the aqueous solution.

44. A process, comprising the steps of:

applying a mask to cover a metal surface of a substrate, the metal surface having an electropositivity less than an electropositivity of silver, the mask being an insulator; and

contacting the metal surface with an aqueous composition comprising silver ions and a complexing agent that is a multidentate ligand, the aqueous composition having a pH of from 2 to 12, to form a coating of silver on the metal surface, wherein the aqueous composition is free of ammonium ions, thiosulfate ions and combinations thereof.